THE SCIENCE NEWS-LETTER

A Weekly Summary of Current Science

EDITED BY WATSON DAVIS

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WEATHER FORECASTS AT SEA MADE SUCCESSFULLY

The extension of the daily weather forecasts to cover the entire North Atlantic ocean is characterized as an imminent development of meteorology by Maj. E. H. Bowie, chief forecaster of the U. S. Weather Bureau, who has recently returned to Washington after a round trip to France on the French merchant training steamship Jacques Cartier. The trip was undertaken under the direction of Prof. C. F. Marvin, chief of the U. S. Weather Bureau, to determine the feasibility of making daily weather maps and forecasts at sea, and, according to Maj. Bowie, was a complete success. Forecasting at sea is entirely practicable, he says.

The trip over and back lasted about six weeks and every day of that trip the forecaster was able to make a morning and night weather map showing conditions over the whole North Atlantic, western Europe and the whole United States and Canada. Reports were received by radio from vessels at sea, from the Navy station at Arlington, and from the French station at the Eiffel Tower.

Forecasts for the whole ocean between the tropics and the latitutde of Iceland were made and broadcast every day from the Jacques Cartier at noon, Greenwich time. The reports from vessels were relayed to Europe and to America where they were of great value to forecasters there through informing them of storms which were on their way across the ocean.

"There was no difficulty in getting enough vessels to furnish us with data," Maj. Bowie said. "They were anxious to cooperate and fairly hungry for the forecasts. This was true even of the big liners which hold their courses irrespective of the weather. They wanted to know what they had to face."

The forecasts were made for the principal steamer tracks such as from the Azores to Bermuda or Gibraltar or Great Britain, or from north European ports to Newfoundland and New York. Special warnings of the approach of storms of unusual intensity were given.

It is entirely practicable, Maj. Bowie says, to put out daily forecasts at sea and to broadcast them by radio for hundreds of miles.

"It would be inexpensive if the principal maritime nations cooperated. Experienced meteorologists and forecasters could be distributed on vessels so that one or two would always be at sea. They would receive the reports from other vessels and from land stations, get up the daily forecasts and broadcast them, and relay the vessel reports to land where they would be of great value. The weather of the ocean can be charted just as easily as that on the land with results of great value both afloat and ashore. It is a field work which has been greatly neglected and its development will be the next forward step taken in meteorological science."

READING REFERENCES- U. S. Weather Bureau. Weather Forecasts in the United States, by a board composed of Alfred J. Henry, chairman, Edwin H. Bowie, Henry J. Cox, and Harry C. Frankenfield. Washington, Government Printing Office, 1916.

EXPLORE LARGEST PREHISTORIC CITY IN AMERICA

The famous Cahokia mounds, lying in the rich American bottoms notfar from the junction of the Missouri and Mississippi rivers and near East St. Louis, Ill,, are the remains of the largest prehistoric city in the United States, W. E. Myer, archaeologist, declared on his recent return to Washington from a visit to this site, which is now being excavated by Prof. Warren K. Moorehead, curator, department of archaeology, Phillips Academy, Andover, Mass., under the auspices of the University of Illinois. Unless action is soon taken to preserve these great mounds, he said, the rapid spread of modern factories in the outskirts of this important manufacturing Illinois city may completely efface the ruins of this ancient Indian metropolis, which exceeds in size any other city occupied by prehistoric man in the United States.

The University of Illinois and also a large number of prominent men throughout Illinois and the adjoining states, are very much alive to the importance of having an experienced archaeologist like Prof. Moorehead carefully explore and study these great mounds, Mr. Myer said. There is now a bill before the Illinois legislature, to appropriate sufficient money to purchase the site of this ancient city and to set it aside as a State park for the pleasure and education of our people forever. They feel that to allow these great mounds to be destroyed would be almost a crime against future generations.

There are eighty mounds in this Cahokia group, scattered over an area of about two thousand acres; but the extreme limits of this old city are still unknown, Mr. Myer explained. The largest of these mounds, known as the Cahokia mound, is by far the largest ever raised by prehistoric races within the boundaries of what is now the United States. This mound is about 998 feet long, 710 feet wide, and rises above the surrounding country to a height of over 90 feet.

These vast earthworks probably at one time contained on their summits temples and chiefs' houses and other important structures.

No accurate estimate can as yet be made as to the date when these mounds were erected or the number of people required to build them. Some of the smaller mounds in this group may possibly be burial gmounds , as modern Indians have been known to raise mounds over the bodies of some of their powerful chiefs or over large numbers of their less important dead.

Several years will be required to complete the exploration of these ruins. Although they have been known to white men for over two hundred years, there has been little intensive exploration of them until the University of Illinois expedition under Prof. Moorehead began work in 1921. It is hoped that this expedition, which is now in the field, will unearth sufficient evidence to enable them to determine what ancient Indian tribe erected these great mounds and lived in this large city.

The builders of these mounds were not a separate race, Mr. Myer added, but were our ancient American Indians. These mounds have been called the Cahokia group because the Cahokias, a small tribe of a few hundred Indians, were found living

in the vicinity when the first white explorers came into the region. These Cahokia Indians did not live upon these mounds. They did not and could not have built the ancient city. The Cahokias stated they found these great ruins of a vanished tribe lying silent and deserted when they first came into the region. No one could tell them who built them, or when or why the vast population perished or departed.

READING REFERENCES Moorehead, Warren K. The Cahokia Mounds, Urbana, Illinois, 1922.
MacLean, John Patterson, Who were the mound builders? In Ohio archaeological and historical quarterly, Columbus, 1904.

Dr. Edwin E. Slosson

CHATS ON SCIENCE

COAL OIL FROM COAL

When kerosene first came into use as a lamp illuminant it was called "coal oil", for it used to be supposed that petroleum had somehow been formed from coal. Later that theory was called in question and geologists are still disputing the origin of oil. We seem likely to use it up before we find out where it came from. But even if coal oil turns out to have been an inappropriate name in the past, it may prove to be true in the future. For petroleum can be made from coal and some day we may have to make it that way.

For the less oil we have the more we use. The lower the supply in the ground the higher the output of our refineries. The report of the Bureau of Mines for January comes to my table today and I find that twenty million gallons of gasoline were turned out every day on the average while for the same month in 1922 the output was fourteen million gallons. This increase cannot keep up forever, however liberally you may estimate our unseen supply underground.

The countries that are short on petroleum are already contriving substitutes. The Germans, who were well supplied with coal but had little oil, began before the war experimenting on methods of making artificial petroleum. Since they have lost some of their best coal fields through the war and oil is harder to get than ever, they have been still more active in such research and it is rumored by returned travelers that they have been more successful in that quest than has appeared in print. What little has leaked out has mostly come through the patents which Friedrich Bergius has taken out in Germany and the United States from 1914 to 1922. But a patent, especially a German patent, is by no means so "patent" as it is supposed to be, so not much is known by the outside world about the details or the practicability of the process.

Theoretically it is simple enough. Petroleum is a mixture of compounds of hydrogen and carbon. Just hitch up these two elements and there you are!

But there are other hitches in the proceedings. Either carbon and hydrogen will unite readily with oxygen, but they have little liking for each other. Only when stirred up by high heat and forced into contact by high pressure will they combine. Besides the expense of the process there is the expense of the materials. Carbon is cheap and abundant enough in the form of coal but hydrogen has to be obtained by tearing it away from the oxygen with which it is combined in water. This may be done by passing steam over red hot iron turnings which pick up the oxygen and release the hydrogen. Or steam may be passed through beds of hot coal which give what is

known as "water gas", a mixture of hydrogen and carbon monoxide, both good combustibles.

In making synthetic petroleum it appears that the coal is first powdered and mixed with heavy oils. This pasty mess is put into a tight steel retort and a current of hydrogen or water gas is run through the vessel at a temperature of some 700 degrees Fahrenheit and a pressure of a hundred atmospheres.

Under these conditions the carbon and the hydrogen gas unite in all sorts of ways and form liquid products, and an oil much like natural petroleum distills off from the retort. This is redistilled; the lighter fractions collected as gasoline, kerosene, benzene and the like, and the heavy residue returned to the retort mixed with the next batch of coal.

It is claimed that by such a process as high as 87 percent of the carbon in the coal can be converted into liquid hydrocarbons, such as are found in natural petroleum and also the coal - tar products which can be used as material for dyes and drugs, preservatives and perfumes. The nitrogen in the coal, which is lost in ordinary combustion, is here obtained in the valuable form of ammonia.

The coal for this process does not have to be of a special quality as is required in making gas or coke by our present methods. Any kind or form of coal can be used and high yields of the hydrogenated products are said to be obtained from the brown coal and lignite of which Germany has an abundance. Peat may be thus worked up into gasoline and other marketable compounds, also pitch, tar, sawdust and any vegetable material.

Although there is little likelihood at present that such a complicated process will come into use here so long as our oil wells continue to flow, it is reassuring to know that when they do run out we shall not be altogether deprived of the efficient fuel that has madd the auto, the airplane and the motor boat possible. We would not know how to get along without the paraffin, vaseline, lubricating oil and innumerable other petroleum products that enter into our daily life. Mineral oil contains so many such valuable substances that it is a pity to burn it up in running steam engines where other fuels may serve. As petroleum gets scarcer, we may expect to see the burning of the crude oil prohibited.

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SCIENCE MAY DISCOVER NEW KIND OF WATER

A new kind of water, unkown in nature, may be created in the laboratory, Sir J. J. Thomson, discoverer of the electron and master of Trinity College, Cambridge, England, predicted in his lectures at the Franklin Institute, Philadelphia, before a selected group of about 300 leading American physicists and other scientists.

Water is made up of two atoms of hydrogen and one atom of oxygen as every high school student knows. Prof. Thomson and many others since his pioneer work on the

electron have been determining how these atoms are arranged. In recent years a theory of the cubical structure of atoms has been worked out that satisfactorily accounts for many chemical compounds. Unfortunately a cubical oxygen atom holds two hydrogen atoms in a symmetrical position. This is not entirely satisfactory because such an arrangement should make water non-polar in its chemical action, while in reality water is a highly polar chemical compound. Now Prof. Thomson suggested that the oxygen atoms are in the form of a twisted cube giving only one possible symmetrical grouping of the hydrogen atoms. This symmetrical grouping is theoretically less stable than an symmetrical grouping which would have properties that would fit the sort of water that we use and drink every day. The symmetrical grouping may be a new allotropic form of water. The new form and ordinary water would be related somewhat like diamond and ordinary black carbon, which are both carbon.

Prof. Thomson believes that the new kind of water is perhaps experimentally realizable by the aid of a strong catalyst, or a substance that helps a chemical operation but does not actually enter into it. If it is found he predicts that it will have a large amount of energy and low stability, and unlike ordinary water, salt dissolved in it will not conduct electricity.

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Millikan, Robert Andrew. The Electron, Chicago, University of Chicago Press, 1917.

EINSTEIN PROOF SO EXACT NO NEW TESTS ARE PLANNED

With results from last September's eclipse in exact accord with the requirements of the Einstein theory, the Lick Observatory considers the proof so satisfactory that it does not plan to repeat the Einstein test at the total solar eclipse that will occur September 10 almost in its own front yard, extreme southwestern California and Mexico.

Dr. W. W. Campbell, director of Lick Observatory of the University of California and leader of the William H. Crocker expedition that secured photographs of the eclipsed sun at Wallal, on the northwest coast of Australia, September 21 of last year, announced that the star measurements agree with Einstein's predictions"as closely as the most ardent proponent of that theory could hope for".

The average of five sets of measurements of the eclipse photographs show displacements of the star images amounting to one and seventy-four hundredths seconds of arc.

Two photographs of the eclipsed sun and its immediate surroundings were secured in Australia with each of two specially designed and constructed cameras with lenses having apertures five inches in diameter and focal lengths of fifteen feet. The four sensitive plates, seventeen inches square, each recorded the images of several scores of stars in the group surrounding the sun, though in reality these stars were many millions of times as far away from us as the sun. The same cameras were used three months earlier on the island of Tahiti to photograph the same stars when they were in the night sky and without the sun in their midst.

Several years ago Einstein said that his theory of relativity must stand three astronomical tests successfully or be revised. One of the three tests consisted of

the eclipse problem which the Lick Observatory astronomers tested. They photographed the stars surrounding the sun at time of total eclipse since the stars can not be photographed at any other time because of the brilliant sky. The relativity theory predicted they would find that the image of a star on the photographic plate whose ray, in travelling from the star to the photographic plate, just grazed the edge of the sun, would be displaced outwardly with reference to the center of the sun's image on the plate through a distance of one and three quarters seconds of arc. The star's light ray would be bent from a straight line by this amount while the ray was passing through the sun's gravitational field.

Director Campbell and Dr. Trumpler of the Lick Observatory have each in recent months measured three of the four Australian plates and the three corresponding night plates completely and independently.

The number of star images measured on these plates varied from sixty-two as a minimum to eighty-four as a maximum. Five out of the six sets of measures have been subjedted to rigorous mathematical treatment, and the five results for the bending of a stellar ray just grazing the sun's edge are in close accord. They vary from a minimum of one and fifty-nine hundredths seconds of arc to one and eighty-six hundredths. The average of the five values is one and seventy-four hundredths seconds of arc.

One pair of Australia Tahiti plates, apparently excellent, remains unmeasured, but results therefrom, ready a month or two later , are not expected to modify the conclusions appreciably.

The Einstein theory of relativity came into public prominence when two British eclipse expeditions reported to the Royal Society of London the results of observations of the 1919 eclipse. One expedition went to Sobral in nothern Brazil and the other one to the island of Principe off the west coast of Africa. On the Brazilian plates the displacement of the star images from their ordinary positions was found to be 1.98 seconds of arc, while on the African plates the difference was 1.60 seconds. Averaging these gives 1.79 seconds which is very close to Einstein's prediction.

The uncertainty of these results, however, led to expeditions of six nationalities observing the 1922 eclipse. The German, Dutch and English party encountered unfavorable weather and were unable to obtain satisfactory photographs.

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LITTLE EFFECT FROM SUNSPOTS ON U. S. TEMPERATURES

Sunspots have no determinable influence on the temperature of the United States as a whole, according to Prof. Alfred J. Henry of the U. S. Weather Bureau who spoke before the recent American Meteorological Society meeting. He told the results of a study of sunspot frequencies and temperature deviations in this country for more than 100 years.

The years of minimum sunspots coincided with years of general high temperature in five out of ten cases, there was a negative fluctuation in three cases and exactly normal temperatures in two. On the other hand the years when there were the greatest number of sunspots were unusually cold in five cases and unusually warm in an equal number.

Evidence was found of the existence of short temperature cycles of irregular length, warm and cold years sometimes alternating and at other times occurring in groups of 3,4, or 5 years. It is difficult, the speaker said, to connect these directly with changes in solar radiation, stating that it was difficult, if not impossible, to disentangle the network of influenceswhith produce fluctuations in terrestrial temperature changes, and that it was hopeless to look for effects of temperature changes from solar radiation in the case of the northern states east of the Dakotas.

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MOST ACCURATE WEIGHING OF LARGEST CRYSTAL TESTS EINSTEIN

A balance so delicate that it will weightthree pounds with an error of not more than one part in a billion is being used by Dr. Paul R. Heyl of the Bureau of Standards in experiments to prove the truth or falsity of the Einstein theory with regard to gravitation. It is the most accurate weighing that science has ever successfully attempted. The results so far are all in favor of Einstein but are only one-fifth completed.

The method involves the weighing of large crystals in varying positions. The largest topaz in the world borrowed from the U. S. National Museum was one of those used. To obtain results of value the utmost refinement of accuracy was necessary, and to those unacquainted with what a scientist means by that expression a visit to the laboratory where the work was done would be illuminating. The proverbial princess of the fairy story who felt a crumpled rose leaf under sixteen feather beds was not more sensitive than the balance used in this work.

It is of the general type of chemical balance used for weighing relatively large quantities but fitted with every latest appliance to avoid error. No human hand comes anywhere near it when it is in use. The crystal to be weighed is first placed in the required position in a sort of frame connected with a series of rods proceeding from the balance case and extending through a brick wall about six feet away. It is then weighed to what would be called extreme accuracy by the experimenter standing in the balance room and putting in the heavier weights by hand. But that is all merely preliminary to the main show.

The whole balance is then encased in movable walls of cork composition about two inches thick, leaving just room enough for the control rods and for the reflection of a beam of light from a lamp outside the chamber wall to shine through and onto a mirror, the swings of which measure the final balancing. The experimenter then leaves the room which is closed tightly with a double door and left to come to a uniform temperature.

This takes nearly an hour, after which the room does not vary one tenth of a degree from one part to another. It is most important that the two arms of the balance shall not vary in temperature by more than one-thousandth of a degree as

this would introduce into the experiment an error of one part in several million whi would ruin its value. The weighing is then made by the operator sitting outside the brick wall and controlling the final delicate weights with the rods projecting through it.

One of the refinements introduced is the use of weights equal in volume to the crystal and supporting frame. The weights and the crystal both displace air as substances sunk in water displace water. If they differed more than two or three per cent.in volume the varying amount of air displaced would introduce a serious error.

Another refinement is to keep the center of gravity of the crystal to be weighed at the same level. The farther from the earth the less the force of gravity, and although an object would have to be carried miles up in the air before it would lose an appreciable part of its weight a change of less than half an inch would be detected by this balance.

According to all the theories of gravitation from the time of Newton to Einstein, it is caused by some sort of mechanical stress either in the nature of a pull or a push upon the things mutually attracted. If this were true, it is expected that crystals would be attracted more or less to the earth and would vary in weight according to the position in which they are placed, for in a crystal the atoms all lie in the same way in a sort of lattice formation and the amount of resistance they would offer to the impact or pull of gravitation would vary according to the way they were placed.

Einstein says on the contrary that gravitation is like the force exerted on a string by a whirling object tied to it; and that it is due to a whirling of the four dimensional universe, which he assumes, in an additional fifth dimension. Dr. Heyl's experiments so far show that Einstein is right. If he really is, there is no cure for gravitation except to iron out the four and five dimension curves which he assumes, or to stop the whirling. Dr. Heyl offered no solution to these problems,which Einstein admitted in a recent reported interview could not be expressed in words.

MAY TRY MALARIA AS LOCOMOTOR ATAXIA TREATMENT

The new malarial treatment for paresis, said to have been tried with great success in Europe and which is now being used on paretic patients at St. Elizabeth's, the U. S. Government Hospital for the Insane, seems worth trying in cases of locomotor ataxia, at least in the early stages, according to Dr. W. A. White, superintendent of the hospital. No trials of it have been made there as there are no sufferers from the disease in the institution.

Locomotor ataxia, or tabes, as the medical men call it, is like paresis, one of the sequels of syphilis. It is a degeneration of part of the spinal cord, causing generally no mental deterioration, but a gradually increasing disability. The disease may be arrested by anti-syphilitic treatment, but curessare rare.

Although it will be years before the results of the malarial treatment of paretics at St. Elizabeth's will be definitely known, experiments made in Europe indicate that infection with a mild type of malaria, known as the tertian, will in time arrest and even improve cases of paresis which were entirely hopeless. Since tabes and paresis both have a similar origin in syphilitic infection it was suggested to Dr. White that the same treatment might be good for both.

"It would seem to be worth trying," he said. "I know that if I had tabes I would take a chance on it for the results obtained abroad on the malarial treatment of paresis are apparently extremely favorable. I know Dr. Wagandt of Hamburg who had reported some of these cases and know him to be most conservative in his statements. His results and those of others in Austria were so decidedly hopeful that we tried the treatment here. It is too soon, however, to say with what success.

"The first treatments were given two paretic patients some months ago. These cases have apparently grown no worse, but paresis is a disease which while under former methods of treatment of utterly hopeless outcome, still has periods of arrest, and it is possible that may be the cause of the stationary condition of our two patients. Recently we injected 15 paretics with tertian malaria but it will be two or three years before we can say whether it has a definite remedial effect.

"Little is known of the physiological method of the remedy but it is thought that the same anti-bodies in the blood which the body produces to fight the malaria germs are fatal to those of the syphilis. It is true that patients who have apparently been greatly benefited by the treatment still show a Wasserman blood test for syphilis, but we are coming to learn that the test may result from other conditions, among them malaria."

Dr. White was asked if it were possible that the malaria germs actually ate up the germs of the more serious disorder, that the blood of the patient was a battleground between two invading hosts. It was not likely, he said, the explanation that the same set of Nature's antidotes for one poison proving effective against the other seeming the more reasonable, and it was this theory that made the possible use of the treatment against locomotor ataxia seem possibly worth trying, although so far as he knew it had not been as yet.

PLAN TO KEEP RECORD OF COD FISH TRAVELS

To get a record of the migratory movements of cod, pollock, and haddock, the U. S. Bureau of Fisheries will begin about April 15 extensive experiments in the Gulf of Maine. Many of these fishes will be caught and numbered metal tags will be clamped on their tails. They will then be released to go their own way. Where they go will be revealed later when fishermen netting the tagged specimens report the number and place where the fish is caught.

MEDIEVAL TRAPPINGS MINGLE WITH MODERN PHYSICS

Black robes and scarlet capes, crimson robes and black caps, trappings dating from the universities of the Dark Ages in Europe surrounded Sir Joseph J. Thomson, master of Trinity College, Cambridge, England, and master of modern physics, while a multi-colored cape was thrown over his shoulders and he received on April 11 at the hands of Provost Penniman of the University of Pennsylvania the honorary degree of doctor of science, the highest honor in the gift of the University.

At his third lecture he stood shorn of his medieval splendor, a slight stooping figure in sober garments. His voice sounded clear and resonant and three hundred of America's foremost scientists followed eagerly his words.

With a few models and a piece of chalk he pictured atoms as groups of electrons and from their grouping explained the behavior of the most varied chemical compounds; why vinegar is sour and alcohol is not; why calcium chloride is a solid and carbon tetrachloride is a volatile liquid; why salt dissolved in water conduct electricity well and when dissolved in alcohol conducts poorly; and why sugar dissolved in either does not conduct at all. Talking about a little known compound, tripotassiumamine, he said; "This compound is mentioned in the books. I do not know whether it really exists or is merely a paper compound but if it exists I venture to predict that when hot it will conduct electricity like a metal and not like an electrolyte."

Diffidently he suggested that the chemists might have a wrong conception of acetic acid, that it might be a mixture of two tautomeric forms. "One advantage in encroaching on another branch of science is that there is no harm done if you are a heretic," he said.

TABLOID BOOK REVIEW

ZIRCONIUM AND ITS COMPOUNDS.- By Francis P. Venable. Chemical Catalog Co., New York.

One of the Scientific Monograph series published by the American Chemical Society. A book by chemists for chemists. After a few introductory pages describing in some detail the occurrence and properties of this moderately rare element, the book is devoted to a recital of its more important chemical combinations and their properties. There is a large bibliography and a valuable list of patents on articles of which forms a part and on processes for its manufacture.

Ninety per cent of the 150 grams of radium, costing approximately $20,000,000, which has been consumed in the United States, has come from the carnolite ores of southwest Colorado and southeast Utah.

On the 91,000 square miles of Rio Grande de Sul, the southermost of the states of Brazil, there are more than a fourth as many cattle as in the entire United States.

Ten thousand tons of tomatoes, cucumbers, cauliflower, onions, grapes, carrots, cabbage and other garden products arrived in the United States from Holland last year.

There are said to be more than fifty tribes of aborigines of unknown origin in Yunnan Province, China, which were there when the Chinese came and which retain most of their prehistoric customs and peculiar languages.

It is estimated that the clothes moth destroys ten thousand tons of wool each year.

In order to give the children enough rest, Fairbanks, Alaska, had to pass a law that all children must be in bed summer evenings by 10 o'clock, although it is still daylight there at that time.

It is planned to replace the old mule cars of Guatemala City with an electric street car system.
